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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,283,029, on September 22, 1999, by AUDIO PRODUCTS INTERNATIONAL
CORP., assignee of Stefan R. Hlibowicki and Gord Van Kessel, for "Loudspeaker
System, and Method of Assembling a Loudspeaker System for Loudspeaker
Subassemblies".

PRIORITY DOCUMENT

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ABSTRACT OF THE DISCLOSURE

A loudspeaker system has first and second loudspeaker assemblies, for example a powered, subwoofer assembly, and a passive subassembly. A ~~mechanical and electrical connection is provided between the two~~

5 subassemblies. This enables an end user to select different pairs of subassemblies, for matching and use together. To ensure accurate matching between the two assemblies, a filter circuit can be provided in the first subassembly, to filter the signal to the low frequency or subwoofer speaker, to give accurate matching with the known characteristics of passive

10 speakers in the second subassembly. The first subassembly can include a switch to enable switching between different modes, corresponding to different second subassemblies.

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**Title: LOUDSPEAKER SYSTEM AND METHOD OF ASSEMBLING
A LOUDSPEAKER SYSTEM FROM LOUDSPEAKER SUBASSEMBLIES**

FIELD OF THE INVENTION

~~This invention relates to loudspeaker systems, and more~~
5 particularly to loudspeaker systems including both passive full range speakers and powered subwoofer speakers.

BACKGROUND OF THE INVENTION

There are a wide variety of different loudspeakers and loudspeaker systems available. Where economy is a key concern and the
10 user will accept adequate performance over a narrower bandwidth, a single speaker can be provided. The bandwidth is determined by the frequency response characteristics of a speaker. A conventional loudspeaker has a drive coil mounted for movement inside a fixed, permanent magnet. The drive coil is connected to a cone, which is provided with a suspension.
15 Movement of the coil, drives the cone, which in turn generates the sound. Accordingly, the speaker has a frequency response, in relation to an input signal, determined by its electrical and mechanical characteristics. It has long been recognized that, for a single speaker, it is virtually impossible to obtain an adequate or uniform frequency response over a very large bandwidth.

20 Accordingly, to generate a uniform response over a wider bandwidth, it is common to provide multiple speakers. A typical configuration can include a speaker covering a middle range of frequencies, sometimes termed a woofer speaker, and another speaker, usually smaller, covering a higher range of frequencies, commonly called a tweeter. These
25 two speakers are usually passive speakers, in the sense that they are not separately powered. As is well known, the power requirements for a speaker depend on the speaker efficiency, volume and bandwidth, and typical spectrum of a music signal. Hence, a speaker covering lower frequencies requires greater power, and it typically consumes 80% of the audio power. It
30 is common to provide a further speaker, commonly called a subwoofer, for

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covering the low frequency range from 100 to 120 Hz, down to possibly as low as 20 Hz.

As a subwoofer can consume up to 80% of the power required for the overall audio signal, it is common to provide powered

5 subwoofers. This avoids having to generate large power levels at the audio amplifier, and distribute the required power to the subwoofer speakers. In a common, stereo arrangement, there are typically two speaker units or assemblies, for the left hand and right hand channels, each of which includes a powered subwoofer speaker. For home theatre or surround
10 sound systems, it is common to provide four individual speaker assemblies, so as to provide, at the front, left and right front speakers, and the rear, left and right rear speakers. Again, each speaker assembly will commonly include a powered subwoofer. The power required for each subwoofer is then generated in the speaker assembly itself.

15 At the present time, there are two basic techniques for providing such an overall speaker assembly comprising a subwoofer, midrange speaker and tweeter. The first is to provide a complete, integrated unit including the three speakers. This has some attractions. It enables the manufacturer to select three speakers of comparable quality and compatible
20 with one another, so as to provide uniform response over the entire, desired frequency range.

Additionally, for the subwoofer, it enables the manufacturer to set response characteristics, so these are accurately matched to the other speakers. For example, controls for a subwoofer commonly
25 include a volume or loudness control, phase control and frequency control, limiting the top end of the frequency range. This enables the speakers to be matched to provide so-called "timbre" matching. This ensures the same loudness across the entire frequency range around the speaker assembly.

The disadvantage with this approach is that there is no
30 flexibility, and for a quality speaker assembly, the cost can be quite high. It requires a customer to commit to a particular speaker configuration, and there is no possibility or option of upgrading part of the speaker assembly. If

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the customer wishes to upgrade his or her speakers, then the entire speaker assembly has to be replaced.

An alternative approach is to provide speaker assemblies, which can be considered as subassemblies, which together can cover the

5 entire frequency range. Commonly, the passive speakers, i.e. the woofer (midrange) and tweeter speakers are provided in a single speaker enclosure or housing. The subwoofer, with its own power supply inputs for power and the audio signal, can then be provided as a separate unit in its own, separate speaker enclosure. This has the advantage that the user can select
10 different combination of speakers depending upon his or her preferences, recognizing that speaker selection is always, to a significant extent, a matter of personal choice.

One advantage of separate subassemblies is that they provide greater flexibility in the initial selection. Also, they clearly enable a
15 user or customer to upgrade the entire assembly by simply replacing part of it. Thus, just the subwoofer assembly could be replaced, or just the subassembly with the woofer and tweeter speakers.

A disadvantage with this arrangement is that, in order to get a true response from the speakers, it requires the controls for the
20 subwoofer to be set, to match the other speakers, and it presupposes that this is indeed possible. Where the speakers are not from the same manufacturer, it may not be easy to achieve a good match between them. Thus, the volume, phase control and frequency of the subwoofer need to be set, to correspond to the passive speakers. This is difficult to do.

25 Accordingly, what the inventor of the present invention has realized is that it is desirable to provide a speaker system, which combines the benefits of the two approaches outlined above. That is a speaker system should provide the flexibility of having individual subassemblies, both to enable a customer to select desired subassemblies on
30 initial purchase, and to enable replacement or upgrade of just part of the overall assembly. At the same time, such an assembly should provide a mechanism or means to enable the subassemblies to be combined, to form a

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complete speaker assembly, in which all the speakers are accurately and properly balanced with one another.

SUMMARY OF THE INVENTION

5 In accordance with the present invention, there is provided a loudspeaker system comprising: a first speaker assembly; a second speaker assembly; and a coupling means providing a mechanical interconnection between the first and second speaker assemblies.

Preferably, the first speaker assembly includes at least one first loudspeaker and a first amplifier therefor, and the second speaker
10 assembly includes at least one second loudspeaker.

The first speaker assembly can include a speaker adapted to cover a low range of frequencies, and the second speaker assembly can be adapted to cover a higher frequency range.

Advantageously, the coupling means provides a pair of
15 electrical connections between the first and second speaker assemblies, for an audio signal from the first speaker assembly to the second speaker assembly, for driving the second speaker assembly. Moreover, the mechanical and electrical connections between the first and second speaker assemblies are preferably integral with one another.

20 In a preferred embodiment, the coupling means comprises two pairs of first and second coupling elements, with the first coupling elements being secured to the first speaker subassembly and the second coupling elements being secured to the second speaker subassembly, the coupling elements being complementary and engagable with one another to
25 provide a mechanical connection and being conductive to form pairs of electrical connections.

The first speaker assembly can include an amplification and equalization circuit, for providing a drive signal to the low frequency speaker and can include a switch means enabling at least one of, the upper
30 end of the low pass frequency range, and the phase to be adjusted.

More preferably, the amplification and equalization circuit

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includes a switch means for switching between at least one fixed filter mode, providing set parameters corresponding to a known second loudspeaker assembly, and a manual mode in which the amplification and equalization circuit can be manually adjusted.

5 Conveniently, the equalization circuit includes an output section having parameters relating to a desired loudspeaker response and the response characteristics of the low frequency speaker, at least one additional section having parameters corresponding to a desired target response and parameters of a known second speaker system, thereby to give
10 accurate compatibility between the first and second loudspeaker systems.

In accordance with another aspect of the present invention, there is provided a loudspeaker system comprising: a first speaker assembly; a second speaker assembly; a connection means providing at least one of a mechanical connection and an electrical connection between the first and
15 second speaker assemblies; and an equalization circuit in the first speaker assembly including at least two separate sections for adjusting the frequency response to match different second speaker assemblies; and switch means for switching between the different sections of the equalization circuit.

A further aspect of the present invention provides a
20 method of selecting and assembling a loudspeaker assembly, the method comprising the steps of:

- (1) providing three or more first and second speaker assemblies, each first speaker assembly comprising a low frequency speaker and an amplifier for driving the low frequency speaker, and each second
25 loudspeaker assembly comprising at least one passive speaker, and there being at least one first speaker assembly and at least one second speaker assembly;
- (2) providing coupling means on the first and second speaker assemblies, enabling each first speaker assembly to be coupled to
30 each second speaker assembly;
- (3) permitting an end user to select a desired pair of a first speaker assembly and a second speaker assembly;

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(4) coupling together the selected pair of first and second speaker assemblies.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

For a better understanding of the present invention and to
5 show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a perspective view of two subassemblies of a complete speaker assembly in accordance with the present invention;

Figure 2 is a view of the passive speaker subassembly of
10 Figure 1 in an inverted configuration;

Figure 3a is a perspective view of a pair of coupling elements;

Figure 3b is a vertical sectional view through the two loudspeaker subassemblies, showing details of the coupling elements;

15 Figure 3c is an end view of the coupling elements;

Figure 4 is a schematic view of an equalization circuit;

Figure 5 is a schematic view of a subwoofer amplifier circuit;

Figure 5a is a schematic view of a power supply for the
20 amplifier circuit of Figure 5; and

Figure 6 is a schematic block diagram of the circuit of the alternative embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to Figure 1, the two parts of a combined
25 speaker assembly 10 are indicated as a first subassembly 12 and a second subassembly 40.

The first subassembly 12 is a subwoofer assembly, and in known manner includes a speaker enclosure 14, which can be conventional, and the details of which are not described here. The speaker
30 enclosure is vented at 16, in known manner. The speaker enclosure 14 has

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generally rectangular faces, and a top face 18 is provided with one part of a coupling arrangement 50, for connection to the second speaker subassembly 40, and the details of this are given below.

A front face 20 of the subassembly 12 has an actual
5 subwoofer 22 mounted therein. Above the subwoofer 22, there is a subwoofer power amplifier indicated schematically at 24, which is provided with subtractive filters, described below. A volume control knob 26 and a frequency control knob 27 are provided. Additionally, there is a switch knob 28 for switching between different modes of operation, as detailed below.

10 In known manner, a cover 30 is provided for covering the controls. In normal use, the cover is mounted in position, and the controls are usually only accessed during the setting up of the speaker, to enable the desired characteristics to be set.

The second subassembly 40 has an enclosure 42. Preferably,
15 the speaker enclosures 40, 42 are visually compatible with one another. As for the first speaker enclosure 14, the speaker enclosure 42 is vented as indicated at 44, although such venting is not essential to the present invention.

A woofer or midrange speaker and a tweeter speaker would
20 be provided in the speaker enclosure 42. Protective grills 46 and 47 are provided for the woofer and tweeter speakers respectively.

Now, in accordance with the present invention, to enable the two speaker subassemblies 12 and 40 to be combined together, the coupling arrangement 50 is provided. This coupling arrangement comprises
25 two first coupling elements 52 mounted on the top face 18 of the first subassembly 12, and two corresponding second coupling elements 54 mounted on a bottom surface 48 of the second subassembly 40. Each of the first and second elements 52, 54 comprises a stamped metal bracket.

The first elements 52, in cross-section, provide a trapezoidal
30 profile, with inclined side faces or first flanges 56, as shown in Figure 3. Additionally, this trapezoidal profile tapers along the length of the first elements 52. Correspondingly, the second elements 54 have two flanges 58,

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which extend outwardly and away from one another, at angles corresponding to the angle of the side faces 56 of the first element. This enables the first and second elements 52, 54 to engage one another in a wedge-type action.

5 To secure the elements 52, 54 to the surfaces 18, 48, screws and nuts 62 are provided. These also secure the ends of electrical leads, indicated at 64, so as to make the electrical connections.

To positively locate the elements 52, 54 relative to one another, a vertical stop 60 is provided at the narrower end of the first
10 elements 52. Then, when the second elements 54 are fully engaged with the first elements 52, the second elements 54 abut the stops 60. The coupling arrangement 50 serves two functions. It provides a secure, mechanical interconnection between the two subassemblies, so as to secure them together as one unit. As shown, the two subassemblies 12, 40 can be
15 configured to be relatively tall and have relatively small footprint. This is aesthetically pleasing, but this coupling arrangement makes it possible for the top or second subassembly 40 to be securely mounted on the lower or first subassembly 12.

Additionally, as another significant aspect of the present
20 invention, the coupling arrangement of the elements 52, 54 provides an electrical interconnection between the two subassemblies, for connection of the audio signal. Thus, the passive speakers in the second or top subassembly 40 are provided with an audio signal through the first and second elements 52, 54. This has the additional advantage that this
25 automatically ensures a correct phase relationship between the speakers of the two subassemblies 12, 14.

Referring now to Figure 4, there is shown an exemplary implementation of an equalization circuit, for incorporation with the subwoofer in the first speaker assembly 12. The equalization circuit is
30 indicated generally by the reference 70. The equalization circuit 70 has an input 72 for the signal for the subwoofer speaker connected to a connector 73. The input 72 is connected to a level control section 74, including an

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operational amplifier and a variable potentiometer 76, for adjusting the level of the signal.

The equalization circuit 70 includes, in effect, three separate sections, identified as a first section 78, a second section 79 and a third

5 section 80. Each of these sections 78, 79 and 80, in effect, includes two separate stages, one of which is identified at 82, for the section 78. Each of these parts 82 is generally common between the different sections 78, 79 and 80, in terms of the overall configuration of the individual components, but it will be understood that different values are selected, to give desired
10 frequency response characteristics for each part and for the sections overall.

Thus, the part 82 includes three separate amplifiers 84, and associated resistors, capacitors and power supply inputs.

The first and second sections 78, 79 have associated with them, additional amplifiers 85 and 86 respectively, and the amplifier 85 is
15 connected through as indicated at P2. These amplifiers 85 and 86 are provided with a signal from an amplifier section 87, which has an input connected to the output of the level control section 74. The amplifier sections 85, 86 and 87 all have characteristics related to the target frequency response.

20 The first and second sections 78, 79, as detailed below, are selected, when the first loudspeaker subassembly 12 is combined with a selected second subassembly 40. As such, they include frequency response characteristics determined from both the desired target frequency response and the frequency response of the passive speakers in the selected second
25 subassembly 40. For a perfect response, this requires adjusting five parameters.

In effect, one first takes a model of the desired frequency response of the entire system, and then one mathematically subtracts from this target frequency response, the response of the passive speakers in the
30 selected second subassembly 40. This gives the desired response for the subwoofer in the first subassembly 12.

On analysis, this requires a fourth order high pass filter,

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which can be obtained from two second order filters coupled together. In effect, each of the parts 82 provides a biquad filter, provided by the three operational amplifiers 84. This gives a biquad filter with a response characteristic which is a second order polynomial divided by a further

5 second order polynomial.

As each of the sections 78, 79 and 80 has two parts 82, their response characteristics are multiplied together, to give, in effect, a fourth order polynomial divided by another fourth order polynomial. As this is multiplied by the frequency characteristic of the subwoofer speaker, pole-
10 zero cancellation can be used to obtain the desired response.

Here, the outputs of the sections 78 and 79 are connected to respective outputs 88 and 89. A further input section 100 for an alternative input signal, detailed below, has an output 102. The outputs 88, 89 and 102 are connected to a switch 92 actuated by the switch knob 28 of Figure 1. The
15 switch 92 has an output 94, connected to an input of the third section 80. The third section 80 again has, in effect, two parts 82, comparable to the sections 78 and 79. The parameters of the section 80 are selected to compensate for the frequency characteristics of the subwoofer.

Turning back to the section 100, this includes a first part 104,
20 including ganged potentiometers 106, for adjusting the low pass frequency response. This first part 104 receives an input from the amplifier section 87, and has its output connected to further amplifiers 108. One of the amplifiers 108 has a switch 110 for adjusting the phase by 180°, while the other amplifier 108 simply acts as an adder, for adding the two alternative signals,
25 as only one signal will ever be present, this amplifier 108 simply passes on whichever signal is present.

The connector 73 has an alternative input 112, for receiving an input signal. This is then fed through amplifiers 114a, 114b, and one can note that amplifier 114b provides a similar function to the amplifier section
30 87.

Thus, in use, the switch 92 can be used to select either one of the sections 78, 79, dependent upon the passive or second subassembly 40

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selected. The section 78 or 79 then provides characteristics, determined from the target frequency response and the response characteristics of the passive speakers. The output of this section is then connected through to the section 80, which further modifies the response, dependent upon the characteristics

5 of the subwoofer speaker.

Alternatively, for manual operation, for example with some wholly different passive speaker unit, the switch 92 is set to connect the output 102 through to the section 80. Then, the low pass frequency can be set using the potentiometers 106. As a further alternative, the input 112
10 can be used as the input to block 100, and again this is passed through the output 102 through to the section 80.

The section 80 has an output indicated at 96, connected through a connector 97, which is a five pin connector, providing connections both for the audio signal, and for receiving a power supply
15 signal from the subwoofer amplifier, described below. A branch connector 98 is provided for auxiliary connection for an indicator light.

Turning now to Figure 5, the circuit for the subwoofer amplifier is shown. The subwoofer amplifier is again indicated generally at 24, as in Figure 1, and, by itself, is conventional to the assignee of the
20 present invention.

The amplifier 24 includes inputs 121 and, 122. The input 121 is connected through to a protection circuit 124, which is configured to prevent overdriving of the subwoofer, and in particular is configured so that, if a user attempts to overdrive the subwoofer, the output signal is
25 modified, to avoid unpleasant distortion effects. The input 122 can be connected to the audio signal for the passive speakers; this covers the whole frequency range, and ensures that, if just a high frequency signal is present, it will be detected, to maintain the subwoofer amplifier active.

The input 121 is also connected to a final power amplifier
30 126 including transistors 128, to amplify the signal to provide the necessary output power. The final output of the subwoofer amplifier is indicated at 130, and would be paired with a corresponding reference terminal 132

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connected to ground. In known manner, as is conventional for speakers, the output 130 would be indicated as red and the ground reference as black.

This subwoofer amplifier 24 includes an additional circuit 134 for automatically turning the amplifier on and off. This circuit 134 is
5 connected to the inputs 122, 123. It includes an amplifier 136, provided with threshold diodes 138, configured so that if the magnitude of the input signal at 122 is greater than 0.6V, the output of the amplifier 136 rapidly changes. This output is connected through to a transistor 130 effectively turning the whole power amplifier 136 on. A further amplifier 142 is configured as a
10 timing circuit, and turns the whole subwoofer amplifier 24 off if no signal of magnitude greater than the 0.6V threshold is detected after a period of five minutes.

Figure 5a shows the power supply for the subwoofer amplifier, identified at 150. This can be largely conventional, and includes a
15 bridge rectifier 152 and smoothing capacitors 154, connected to positive and negative rails 156, 157. The rails 156, 157 are connected through transistors 158, 159 to positive and negative outputs indicated generally at 160 and 161, for connection to appropriate elements of the circuit as indicated.

While the invention has been described as including a
20 switch 92 in the first subassembly, to enable switching between different characteristics, corresponding to different, known second subassemblies, other techniques are possible. For example, the first subassembly can be provided with some sort of sensor to automatically sense the presence of different second subassemblies. One simple way to achieve this would be to
25 provide a switch or series of switches on top of the first subassembly, which is mechanically actuated by some projection from the second subassembly, and each second subassembly could then be provided with an appropriate projection. Alternatively, this could be done in some remote manner, by use of some transmitting electrical or magnetic signal.

30 Other possibilities for the individual components or subassemblies to recognize different subassemblies include: parameter sensing circuitry, position switches, and user controlled switches.

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Reference will now be made to Figure 6, which shows a variant or development of the present invention. The embodiment described above has been based on two speaker assemblies, one being an active, powered assembly and the other being a passive assembly. It is

5 envisaged that the invention could be expanded to include three or more speaker assemblies, including a mixture of active and passive subassemblies, or just all active subassemblies, or just all passive subassemblies. In this Figure 6 like components are given the same reference numeral as in earlier figures, the description of these components
10 is not repeated.

The speaker enclosure of the first speaker subassembly 10 is again indicated at 14. Within it, as indicated above in Figure 4 there are located the level control sections 74, section 78, 79 and 100 for adjusting or filtering the signal, the common section 80, the subwoofer amplifier 120 and
15 the subwoofer 122 itself.

The selection switch 92 is indicated here as two separate switches 92a, 92b. 92a is a mode switch for switching between a solo or manual mode, in which the speaker assembly 10 is not connected to any specific assembly 40. In this mode, as described above, the equalization
20 circuit 70 can be adjusted manually as desired, and usually will be adjusted manually to achieve a best match with some other passive speaker unit.

In the alternative, connected mode, the signal is switched through the second switch indicated at 92b, which enables switching through either the filter section 78 or the filter section 79, again as detailed
25 above.

Figure 6 also shows a power source 160 connected to the speaker enclosure 14 and an audio amplifier 162 providing the original audio signal to the speaker enclosure 14.

Now, it is recognized that, in addition to the powered or
30 active first speaker assembly 12, there could be an additional powered or active speaker assembly. This is identified using the same reference numerals but with a prime indication to distinguish; thus, this additional

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speaker assembly is identified as 12'.

The individual elements of this additional powered or active speaker assembly 12' are identified correspondingly. It can be noted that an audio signal connection is provided as indicated at 164, which can be

5 either for a single channel or a multiple channel, depending upon the nature of the speaker. The description above has been for a single channel speaker, but it will be recognized that the speaker assembly 12', or indeed any of the speaker assemblies could be multi-channel assemblies, or at least capable of further transmitting two or more audio channels on to other
10 speaker assemblies. As this speaker assembly 12' is powered, a power connection is provided at 166.

As indicated at 40, the second loudspeaker subassembly could be provided on top of or otherwise connected to the additional powered speaker assembly 12'. A connection at 168 is indicated, for the
15 mechanical and electrical connection between the units 12', 40, which, for this passive unit, need only provide a connection for the audio signal.

Accordingly, the combined assembly, comprising the speaker subassemblies 12, 12' and 40 would comprise two powered or active subassemblies and the passive subassembly 40. As noted above, in general,
20 any desired combination of active and passive components can be provided.

With respect to the connections 164, 166, each of these provides the necessary electrical connection. The mechanical interconnection can be provided, if desired, integral with one or other, or both, of the electrical connections 164, 166.

25 It is envisaged that a complete line of loudspeakers could comprise three alternative subwoofers, a first loudspeaker assemblies 12 and four passive or second loudspeaker assemblies 40, sometimes called satellite speakers. In a practical embodiment, there are restrictions as to which units can be combined together, because of size, etc.; overall, this yields six
30 possible combinations.

It can be noted that the equalization circuit and the amplifier for the subwoofer can be implemented in various ways. Here,

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subtractive fillers are used, but other known techniques are possible. Also, there could be greater integration between the equalization circuit and the subwoofer amplifier.

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CLAIMS:

1. A loudspeaker system comprising:
a first speaker assembly;
a second speaker assembly; and a
5 coupling means providing a mechanical interconnection
between the first and second speaker assemblies.
2. A loudspeaker system as claimed in claim 1, wherein the
first speaker assembly includes at least one first loudspeaker and a first
amplifier therefor, and wherein the second speaker assembly includes at
10 least one second loudspeaker.
3. A loudspeaker system as claimed in claim 2, wherein the
first speaker assembly includes a speaker adapted to cover a low range of
frequencies, and the second speaker assembly is adapted to cover a higher
frequency range.
- 15 4. A loudspeaker system as claimed in claim 3, wherein the
coupling means provides a pair of electrical connections between the first
and second speaker assemblies, for an audio signal from the first speaker
assembly to the second speaker assembly, for driving the second speaker
assembly.
- 20 5. A loudspeaker system as claimed in claim 4, wherein the
mechanical and electrical connections between the first and second speaker
assemblies are integral with one another.
6. A loudspeaker system as claimed in claim 5, wherein the
coupling means comprises two pairs of first and second coupling elements,
25 with the first coupling elements being secured to the first speaker
subassembly and the second coupling elements being secured to the second

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speaker subassembly, the coupling elements being complementary and engagable with one another to provide a mechanical connection and being conductive to form pairs of electrical connections.

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7. A loudspeaker system as claimed claim 3, wherein the first
5 speaker assembly includes an amplification and equalization circuit, for providing a drive signal to the low frequency speaker and including switch means enabling at least one of, the upper end of the low pass frequency range, and the phase to be adjusted.
8. A loudspeaker system as claimed in claim 7, wherein the
10 amplification and equalization circuit includes a switch means for switching between at least one fixed filter mode, providing set parameters corresponding to a known second loudspeaker assembly, and a manual mode in which the amplification and equalization circuit can be manually adjusted.
- 15 9. A loudspeaker system as claimed in claim 8, wherein the amplification and equalization circuit comprises an amplification circuit and a separate equalization circuit.
10. A loudspeaker system as claimed in claim 9, wherein the
20 equalization circuit includes an output section having parameters relating to a desired loudspeaker response and the response characteristics of the low frequency speaker, at least one additional section having parameters corresponding to a desired target response and parameters of a known second speaker system, thereby to give accurate compatibility between the first and second loudspeaker systems.
- 25 11. A loudspeaker system comprising:
a first speaker assembly;
a second speaker assembly;
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a connection means providing at least one of a mechanical connection and an electrical connection between the first and second speaker assemblies; and

an equalization circuit in the first speaker assembly

5 including at least two separate sections for adjusting the frequency response to match different second speaker assemblies; and switch means for switching between the different sections of the equalization circuit.

12. A loudspeaker system as claimed in claim 11, wherein the equalization circuit includes at least one section with fixed parameters and
10 at least one section including manual control of at least one of low pass frequency range, phase shift and amplitude level.

13. A loudspeaker system as claimed in claim 12, wherein the equalization circuit includes subtraction filters.

14. A loudspeaker system as claimed in claim 13, wherein the
15 first loudspeaker assembly includes an amplifier connected to an output of the equalization circuit, and a low frequency speaker connected to and driven by the amplifier.

15. A method of selecting and assembling a loudspeaker assembly, the method comprising the steps of:

20 (1) providing three or more first and second speaker assemblies, each first speaker assembly comprising a low frequency speaker and an amplifier for driving the low frequency speaker, and each second loudspeaker assembly comprising at least one passive speaker, and there being at least one first speaker assembly and at least one second speaker
25 assembly;

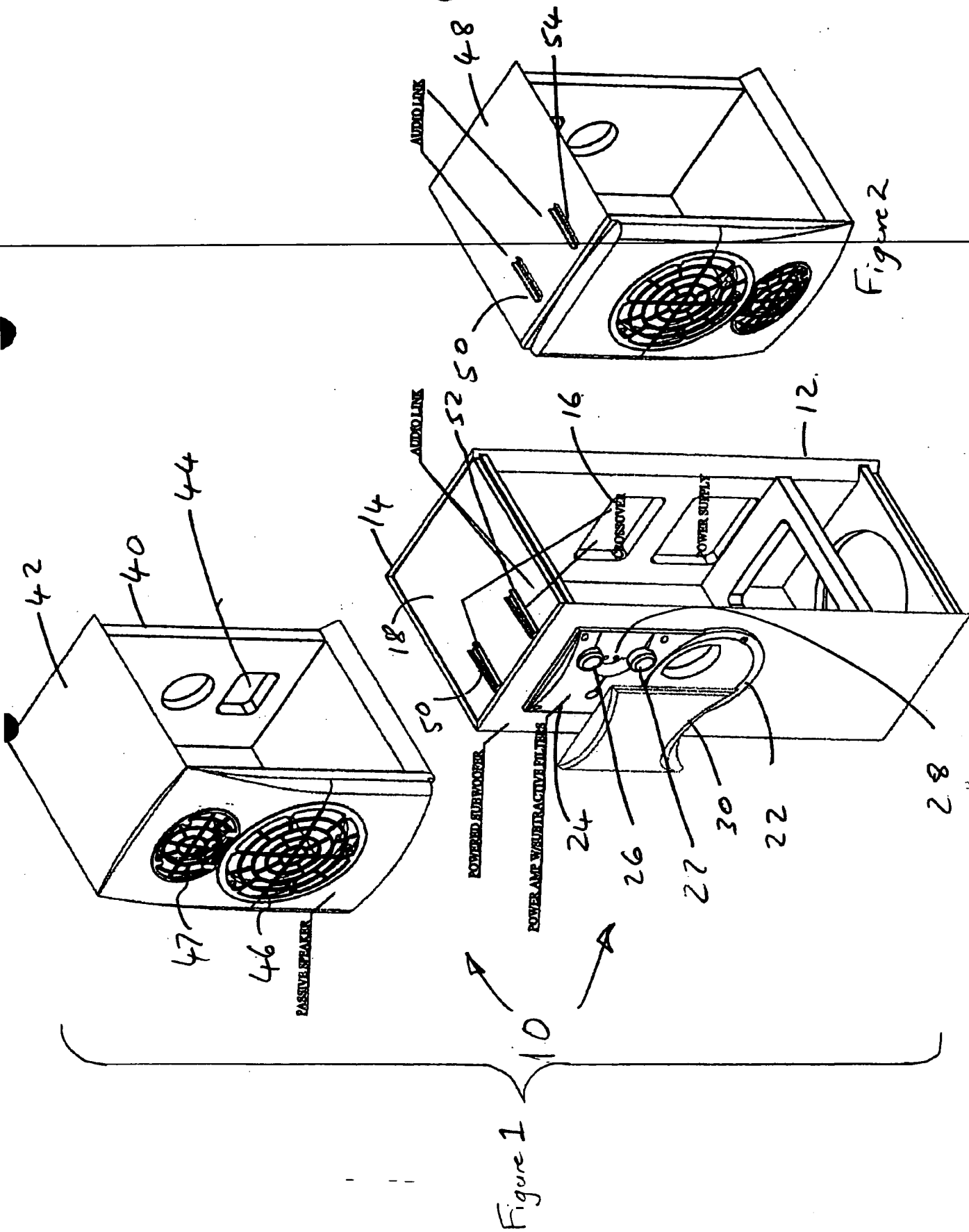
(2) providing coupling means on the first and second speaker assemblies, enabling each first speaker assembly to be coupled to each second speaker assembly;

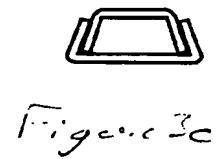
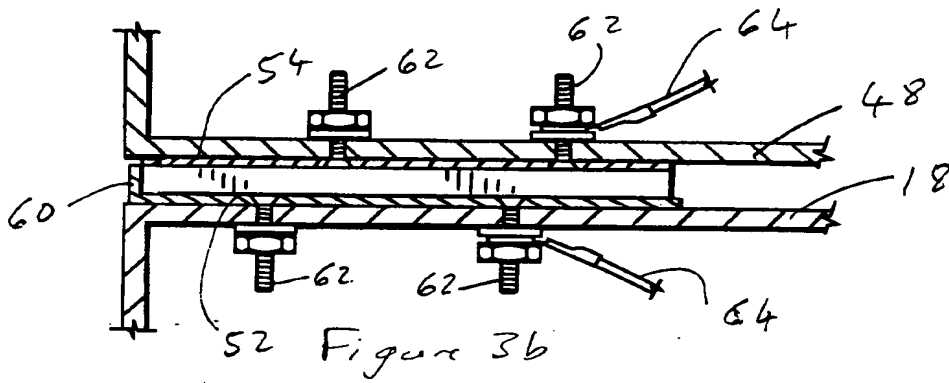
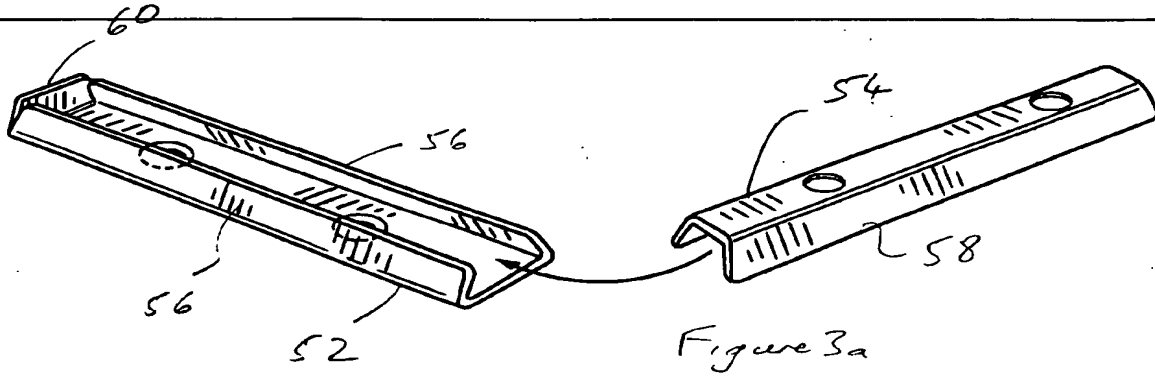
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(3) permitting an end user to select a desired pair of a first speaker assembly and a second speaker assembly;

(4) coupling together the selected pair of first and second speaker assemblies.

- 5 16. A method as claimed in claim 15, which additionally includes providing an equalization circuit in the first speaker assembly, the equalization circuit including a plurality of filter sections corresponding to different second speaker assemblies and a selection switch, and the method further comprising actuating the selection switch to select a filter section
- 10 corresponding to the selected second loudspeaker assembly, thereby to provide accurate matching between the response characteristics of the first and second loudspeaker assemblies.
-





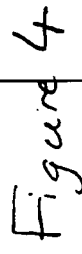
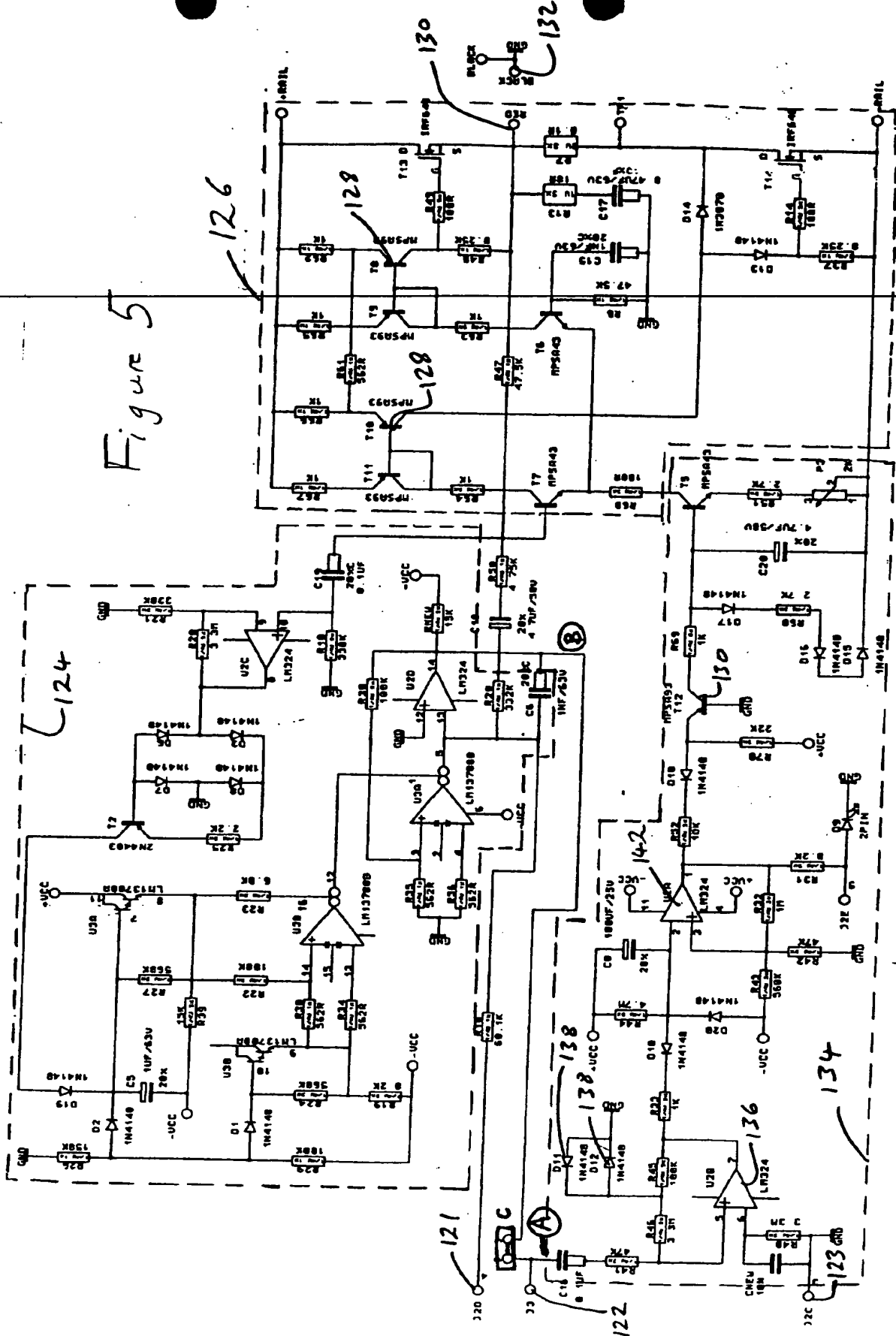


Figure 5



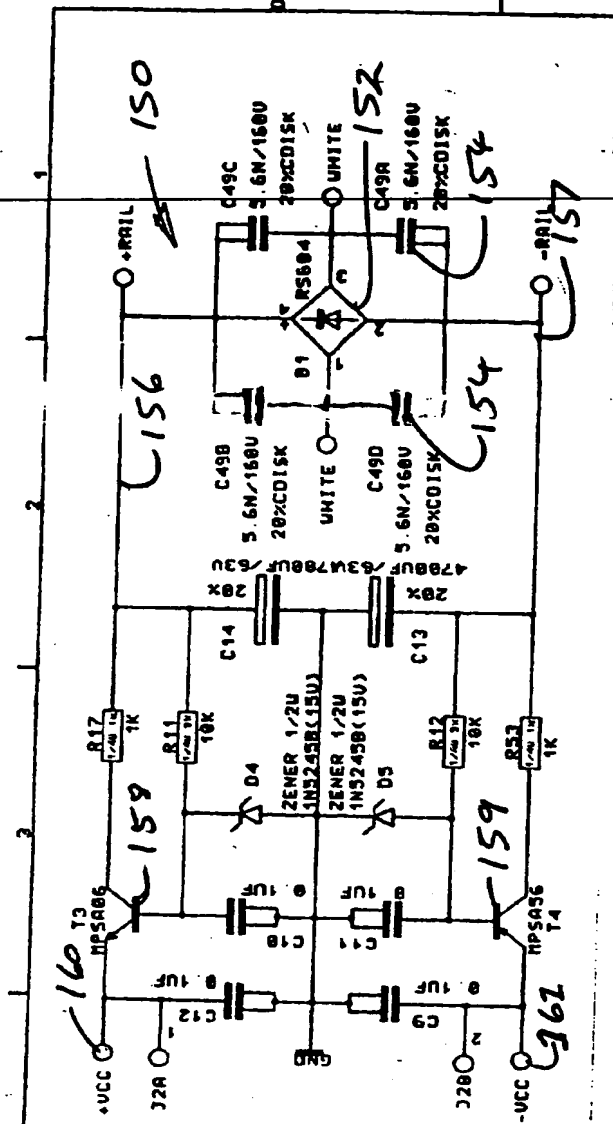
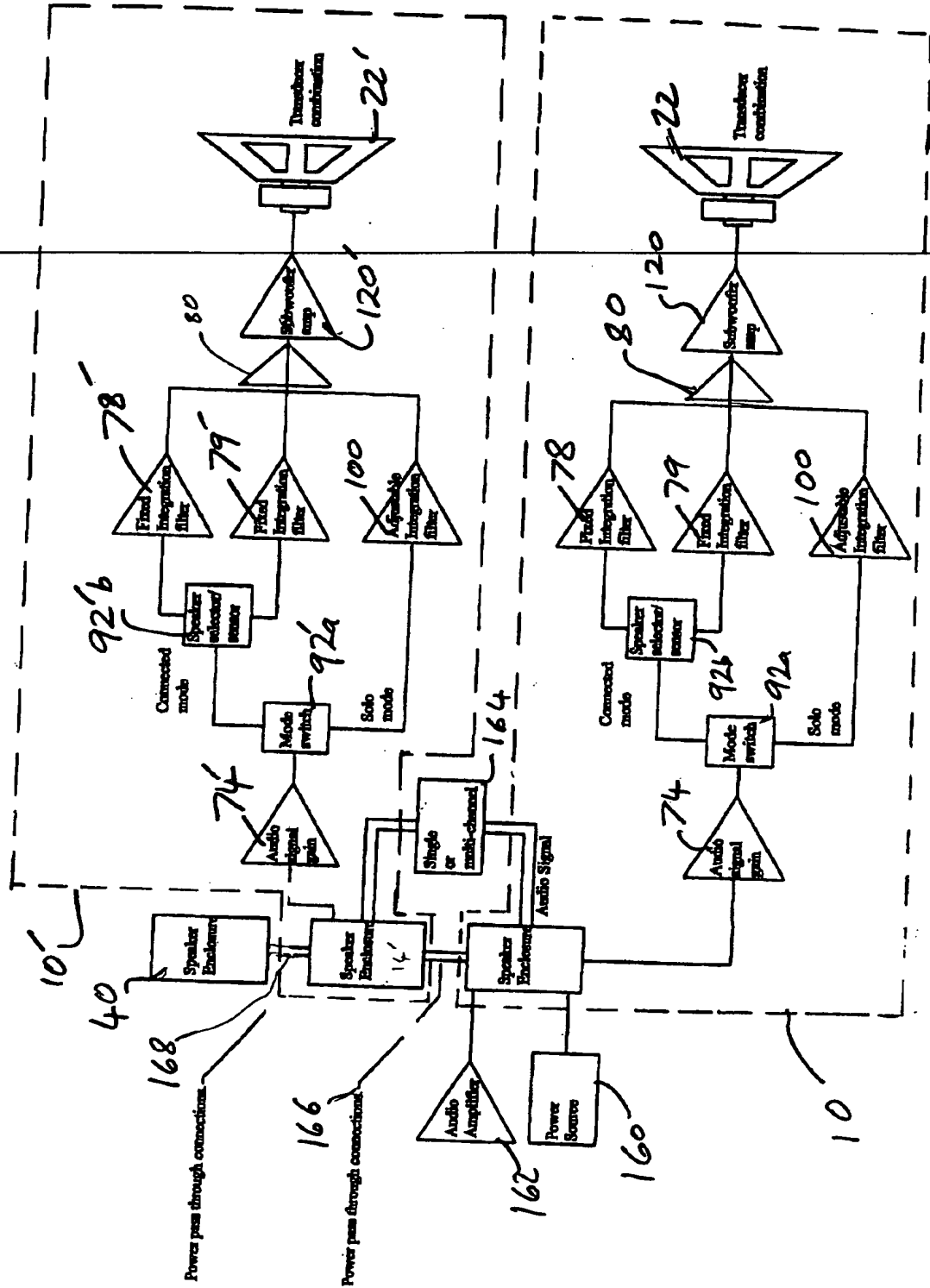


Figure 5a.

Figure 6



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